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25 YEAR RE-REVIEW

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[redacted] opening of the port of Tientsin to foreign traders, [redacted] the convention concluded at Peking in [redacted] representatives of the British, French and [redacted] on the one side and the Imperial Chinese [redacted] on the other side. Shortly thereafter, foreign [redacted] vessels began to compete with Chinese sea-going junks [redacted] the carrying trade, and about a decade later foreign steam [redacted] came to participate in the trade. Those during the [redacted] generation gradually ousted both foreign and native [redacted] craft. The foreign sailing vessels were of about 400/700 tons burden, while the steam ships were of 700 to 1,[redacted] tons burden.

At the approach to the port, the first obstacle to be [redacted] with was Taku Bar, a formation the result of sea and wind action, constituted of silt brought down by the river and its tributaries from inland. Its crest about a mile wide and then (1900) about five miles out from the mouth of the river, could only be crossed at periods of high tide by vessels not exceeding ten feet in draft, while at periods of low water there was only wading depth, and at certain times parts became dry.

Having negotiated the Bar, vessels proceeded through a channel; the outer part called the Deep Hole and the inner part through mud banks (covered at times of high water); for a distance of about 4 miles, and reached the mouth of the river. Here on both banks were forts built of earth and lime concrete, and garrisoned by Chinese soldiery.

More generally called the Pei Ho, or North River, but locally by the natives, the Hai Ho or Sea River, its waters as already inferred were very turbid. It was a tortuous stream in that near its mouth it had a series of bends forming the letter S, and higher up about a dozen very bad bends, the worst of them having a radius of only 400 feet, whereas the minimum radius to permit of efficient navigation outhgt to have been at least 1,500 feet.

[redacted] width at its mouth about 600 feet and at Tientsin about 250 feet, its length was about 50 statute miles, or nearly 40 nautical miles. The distance between the mouth of the Hai Ho and Tientsin, as the crow flies, is however only 30½ miles. Its depth of water was until the later Eighties sufficient to permit of navigation to Tientsin of vessels which had crossed Taku Bar. [redacted] had to be warped round the bends getting aground over and over Again. Steamers, however, used to run their bows ashore, and as soon as their sterns had swung round, would back off until their bows were clear, and then proceed, repeating this manoeuvre at each of the bad bends.

Just above Tientsin the Hai Ho is fed by four tributaries, from East to West as follows:-

Pei Yun Ho (Ho Ta Grand Canal) draining the mountainous region [redacted] north east of Peking.

Yung [redacted] Ho, draining the mountainous region North-[redacted] west of Peking.

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[redacted] (West River) a continuation of the Ta Ching Ho and [redacted] Ho, which have their origins in the East Shansi [redacted].

[redacted] (South Grand Canal) draining the mountainous [redacted] of Shansi and Honan.

[redacted] is a comparatively clear water stream, but [redacted] waters of the last two names have silt carrying capacities estimated by weight at from 2½% to 4%, while the waters of the Hung Ting Ho have been estimated to carry silt to the enormous extent of 8/10%.

Practically throughout their lengths over the flat Chihli plain, these tributaries have been kept to their courses by embankments built up by the natives during the distant past, and have become as it were aqueducts, in that their beds at various stretches are at a higher elevation than the surrounding country.

Ice dictated a closure of navigation from about the middle of December until the end of February or beginning of March.

All over the Northern provinces of China the intensity of rainfall is very unevenly distributed throughout the year. Comparatively little snow falls during the Winter, and during the Spring and Autumn the rainfall is very scanty, but the two months July and August are notorious for heavy rain storms. Summer rainfall of high intensity is primarily connected with cyclonic storm movements known as typhoons, and serious floods are almost invariably due to these typhonic rainstorms. Typhoons usually originate in the Pacific Ocean in the region of the Marianne and Caroline Islands, and those which occur in July and first half of August, after striking the coast of China North of Hongkong, usually in the course of their curve hit and break up against those part of the mountain barrier lying to the West of the Chihli plain. Owing to deficiency of vegetation on the mountains, the run-off of rain is very intense and causes disastrous erosion of the mountain slopes, hence the silt brought down in the rivers. It may be said therefore that the stage of high pressure of floods caused either a scouring action or a rolling of silt along the bed slopes until the silt eventually came within the influence of sea and wind action outside the mouth of the Hai Ho. However, under the said high pressure, it almost invariably happened that a break occurred at one part or another of the embankments of the tributary affected by flood, or breaches were made by natives at one village or another in order to deflect flood waters from inundating their crops. In whatever manner such breaches were made, it not only happened that large areas of land became inundated, but thereby by the slowing of the speed of flow along the tributary concerned, precipitation of silt became resumed or renewed, until in the course of time or a concatenation of circumstances, the Hai Ho became adversely affected.

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The plains around Tientsin were frequently under water, and the first great flood witnessed by foreigners appears to have been that of the Summer of 1871, which was described as the result of a greatly prolonged steady downpour, and as having covered an extent of country computed at about 300 miles from North to South and about 200 miles from East to West. There does not appear to be any record or data as to what effect this flood had upon the Hai Ho but it seems to have been the incentive to holders of land in the British Concession at Tientsin to raise the level of their land by earth carted from the adjoining area.

Attention to increased difficulties in navigating the Hai Ho seems to be inferred from the fact that at the Annual General Meeting of Landrenters of the British Concession held on the 29th January 1887, a sum of Taels 2,000 was voted for a probable survey of the Hai Ho.

Again particulars are lacking regarding several inundations in the years 1867 and 1888, but perhaps something may be inferred from an editorial in the "Chinese Times" of the 3rd August 1889, as follows:-

"The process of silting up still continues in the Tientsin Reach and is apparently going on faster down towards the Pine Forts Reach where steamers now discharge their cargo. Soundings taken at low tide during the past week show that between the New College and the Tientsin Bend there was 6½ feet of water; through the East Reach and from Horlestling Bend to Double Bend 6 feet; and through Arsenal Bend 6½ feet. On Thursday a 12 foot tide on Taku Bar caused a 14" rise at the Bend, so that the depth of water in the Tientsin Reach at high tide was 6'8", and from that point to the Arsenal Reach could not have been over 6 feet. Steamers are compelled to lie in the upper Pine Forts Reach, which is one of the best reaches in the river, just above Pei Tang Kou, situated about 12 miles from Tientsin. Any amelioration of the distressing condition of the river is anxiously looked for; very few persons of the Settlement being entirely free from inconvenience on account thereof. The Shipping Agencies are of course the greatest sufferers."

None of the inundations before witnessed by foreigners and natives living, equalled in disastrous consequences the sudden and wholly unexpected deluge which in July 1890 swept the hilly region of the province over its plains to the sea. On the last day of the month there were ominous signs of some great calamity approaching Tientsin. Communications by the native telegraph lines all of a sudden collapsed. Couriers [illegible] places in the interior did not arrive and couriers despatched with mails inland returned, having met with water everywhere. Navigation on the various rivers which at or near Tientsin unite with the Hai Ho stopped. From hour to hour the water rose until on the 31st. matters became desperate. The French settlement (then still in an undeveloped state) was during the preceding night completely submerged, and in front of the British Settlement the level of the Hai Ho was awash with that of the Bund. Fortunately for Tientsin at this most critical moment, the embankments gave way

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None of the inundations before witnessed by foreigners and natives living, equalled in disastrous consequences the sudden and wholly unexpected deluge which in July 1890 swept the hilly region of the province over its plains to the sea. On the 18th day of the month there were ominous signs of some great calamity approaching Tientsin. Communications by the several telegraph lines all of a sudden collapsed. Couriers despatched from places in the Interior did not arrive and couriers despatched with mails inland returned, having met with water everywhere. Navigation on the various rivers which at or near Tientsin unite with the Hai Ho stopped. From hour to hour the water rose until on the 21st. matters became desperate. The French settlement (then still in an undeveloped state) was during the preceding night completely submerged, and in front of the British Settlement the level of the Hai Ho was awash with that of the Bund. Fortunately for Tientsin at this most critical moment, the embankments gave way

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some distance from Tientsin, when, through wide gaps soon cleared by the rush, the huge mass of water could expand its force by spreading over the plains to the East and South, finding outlets into the lower courses of the Pei tang River and the Hai Ho. Situated as Tientsin is at the junction of several water-courses that drain a vast region of North China, and in the centre of a hollow equal in extent to 800 square miles, this flood proved once more that the river and canal works executed by the Chinese during the preceding two decades, had not improved its position or provided for the agricultural prosperity of the province, of which Tientsin is the commercial emporium.

The Yung Ting Ho or Hun Ho was again the chief cause of this disaster. A short distance below Lu Kou Chiao, to the South-West of Peking, its wild waters effected a breach 2,500 feet wide in its embankment, and thence, leaving its usual bed almost dry, swept over the districts of Wu-Ching and Jung-an towards Tientsin destroying in its course several hundred villages.

According to information gathered at the time, it was said that over an area of at least 6,000 square miles, the crops were completely destroyed, and that between 15,000 and 20,000 of the inhabitants perished in the floods. Also that in the beginning of winter, about four million inhabitants of the province were dependent on Government relief; and that the loss incurred through the destruction of crops, homesteads and movable property was not less than thirty million taels.

The first serious effort to improve the Hai Ho was made after this disastrous Flood, when Viceroy Li Hung Chang was induced to allow [illegible] de Linds to make the surveys on which was based a proposal of Mr. G. Detring the Commissioner of Customs, of an extensive scheme that contemplated an outlay of a million taels. This proposal had the great advantage, but dimly realised at the time, of beginning the conservation work before the state of the river, as regards navigation, should have become as disastrous as it subsequently did. Although the money for its prosecution was available, this timely plan met such strong opposition from the local Chinese officials that it had to be abandoned.

In the absence of any reference in the Chinese Customs Trade Reports for the years 1891 and 1892 to extraordinary difficulties in navigation of the Hai Ho, one may infer that the pressure of water that flowed down that river during the floods of 1890 perhaps had a scouring effect and cleared away most of the shoals referred to in the report of the 3rd August 1889. Such is borne out to a certain extent from the report for 1892, which year also witnessed a flood. This report states:-

"In August the country around Tientsin was flooded - now apparently an annual infliction - and the bed of the Hai Ho underwent extraordinary changes. The melting of the heavy Winter snows in the mountains and a copious rainfall during July and August, filled to overflowing the many rivers and canals intersecting the low country about Tientsin, and a strong freshet in the river ran throughout the month, varying in speed from 2 to 5½ knots.

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The country to the South of the river was inundated to a less extent than in the previous year, due probably to the works of embankment and diversion of the Hung Ming Ho carried out during the Spring by Mr. Griffin, but to the North the water rose over the plain to a deapth of 6 feet. From a diagram prepared by the Harbour Master showing the rise and fall of water and the rise and fall of the river bed in the centre of the channel opposite the Harbour Master's office, during the year, it appears that on the 20th July there was a depth of 12 feet of water only and a rise in the river bed of 12 feet. At the beginning of August the upper reaches of the river began to scour out with most remarkable rapidity. Between the 23rd July and 29th August the total scour opposite the Harbour Master's Office was 15'10".

"From the 11th July to the 16th August, steamers discharged and loaded at Tongku, but on the latter date the ss."Lienshing" succeeded in reaching Tientsin Bund, and the channel gradually improving, steamers were soon able to come up as usual."

A report made at the end of 1895 stated that the Hai Ho behaved moderately well, although during the months of July, August and September, steamers were compelled to lighter a good deal of their cargo and for some weeks could not navigate the upper reaches. Also that in the latter half of July, three steamers had great difficulty in getting down, and suffered much delay.

Upon the re-opening of the Hai Ho about the 20th February 1896 it was found to be in good condition and the first arrival - the ss."Esang" - reached Tientsin Bund on the 9th March. However, at the end of March signs of silting up were again apparent and the river shoaled with extraordinary rapidity, preventing steamers from making the passage to the Bund.

Another flood in August found weakness in the bank of the river at Lu Chia Tai close to the Tientsin Bund, and the waters began to pour over the plain. Consequently the stretch of the river immediately below the breach was restricted of the normal flow of water, and became reduced in depth to only 3'2", and in fact the natives were able to wade across the stream. Even partially loaded lighters were unable to pass, and native boats in hundreds were requisitioned to take their place, but even the larger of those could not be used with practicability. The Taku Tug & Lighter Co., Ltd., made extraordinary exertions over a period of about three weeks to scour the badly shoaled section by means of centrifugal pumps mounted in steam tugs, applying hydraulic pressure through hoses. In the course of this work their steam Tug "Heron" starting from Tientsin on the 9th September with a draft of 5'8", did not reach Taku until the 22nd instant, having spent nearly the whole of the time in effecting a channel through the badly shoaled section estimated at about 8 miles. These exertions were partially crowned with success, in that on the 21st instant, two lighters were enabled to reach Tientsin Bund; followed thereafter by others whose draft did not exceed 5 feet.

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The breach in the river bank having been closed, there resulted a sufficient improvement in the state of the river, towards the close of the season to allow of steamers on a light draft to reach Tientsin Bund.

Meanwhile during the year, not only foreigners but Chinese, began to take alarm, and following several meetings held locally, the Tientsin General Chamber of Commerce, in order to obtain some data on which to proceed, entrusted the task of making a survey and drawing up a report to Mr. A. de Linde, a civil engineer who had for some years taken an interest in and devoted much attention to this subject.

In April 1897 the Native Authorities had a dredger at work, from time to time, in the North-West Reach, without however producing any appreciable result. What was needed was not the removal of silt from one or two places, but rather the prevention of the deposit, and this a dredger could not do.

The tale respecting the year (1897) was that for over six months the depth of water in the Hai Ho ranged between 5 and 8 feet only, and after March but one steamer reached Tientsin Bund. All merchandise had to be conveyed to and from the Settlement in lighters, too often unable to carry their full complement of cargo; with consequent great delay; and involving loss by damage and theft.

Eventually, during that year the first HAI HO CONSERVANCY COMMISSION was appointed by agreement between the Viceroy Wang Wen Shao, Count du Chaylard, Consul-General for France and Senior Consul; Mr. H. B. Bristow, His Britannic Majesty's Consul General, and Mr. Edmund Cousins, Chairman of the Tientsin General Chamber of Commerce, and was constituted of:-

The Tientsin Customs Tao tai; two Chinese officials nominated by the Viceroy as the representatives of the principal Chinese Companies, the China Merchants Steam Navigation Coy. and the Chinese Engineering and Mining Coy; the Commissioner of Customs; and Representatives of the following:- the different shipping and lighter companies; the Foreign Concessions (in existence at the time); and the General Chamber of Commerce.

The said Commission does not appear to have held any meetings but business was conducted by the Senior Consul, the Customs Tao tai and the Commissioner of Customs, with Mr. A. de Linde as Adviser, and the latter's scheme for initial improvement works was adopted. The finance was provided by a contribution of Taels 100,000 by the Viceroy and the raising of a loan of Taels 150,000 sponsored by the British Municipal Council. This bore interest @ 6% p.a., repayment to commence at the expiration of one year and it was anticipated that amortisation would be completed within 12 years. The payment of interest and principal was secured by a levy of River Dues of ½ per mille ad valorem on all imports and exports - being 1% of the Customs full duties - for the period of 12 years, as well as by the property and assets of the British Municipality.

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The works, which comprised the closure by locks of three lateral canals, and training of portions of the Hai Ho where the breadth of river was out of proportion to the volume of ebb and flow, were commenced in August 1898, but progress was retarted by the abnormal height of waterways, owing to drainage of overflow of the Huang Ho (Yellow River) via the Nan Yun Ho into the Hai Ho.

No steamers were able to reach Tientsin Bund during 1898, and only the small steamer "Kwangchi" and s/s "Shengking" succeeded in doing so during the year 1899. Moreover the latter with a draft of 9 feet was unable to swing around at Tientsin and had to back down river some [illegible] miles; getting aground several times, and being obliged to discharge cargo before she was able to swing. Her passage to Taku having occupied 3 days.

Tugs and lighters found navigation fairly good, and as the depth of water in the river was not less than 7½ feet, the latter were enabled to carry full cargoes. The increased depth of water was attributed to exceptionally small rainfall in July and August; consequently a lessening in silt brought down.

The principal lock, known as the Chen Chia Kou lock on the Hutai Canal (leading out of the Hai Ho opposite to Tientsin Native City) was completed on the 11th January [illegible], and the effect was to augment the volume of water in the Hai Ho to the extent of causing a rise opposite to the foreign settlements of 1'3" in 10 days. Other locks, one at [illegible] on a canal (leading out of the Hai Ho at about the distance between Tientsin and Taku) and the other at [illegible] on a canal (leading out of the Hai Ho opposite to Tongku) were completed on the 16th May, and beneficial effect was immediately apparent, in that the tidal range became increased by nearly 1'3" to about 1½ feet.

The training works in certain parts of the Hai Ho, from which Mr. de Linde expected much, were interfered with so constantly by villagers - and perhaps soldiers during the course of the Boxer Uprising in the Summer of 1900 - that they did not have a fair trial.

The labours of this Committee were [illegible] as a consequence of the Boxer troubles in the summer of 1900. However, afterwards a claim was made upon the Chinese Government through the Consular Body, in respect of the damage wrought on the improvement works during that summer, and the sum of Taels [illegible] was allowed, which provided an available security for a Fund for the rehabilitation of the injured works.

The British Military Authorities availed themselves of Mr. de Linde's services during the Summer and Autumn, to maintain the river at as high a point of navigability as possible - this in order that communication between Tientsin (and thence Peking) and the sea might be unimpeded for the movement of troops and supplies.

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Only 4 steamers were able to reach Tientsin Bund during the year.

After a second Commission appointed by the Tientsin Provisional Government early in 1901 failed to carry out any work in consequence of lack of unanimity and support of the various interests concerned, it was in May definitely agreed that the Commission should be constituted as follows:-

A member of the Tientsin Provisional Government (to be replaced by the Customs Taotai on the rendition of Tientsin City to the Chinese Government - which took place on 15th August 1902). A member of the Consular Body, and the Commissioner of Customs.

To the above were added, but with consultative voice only:-

Consular representatives of the various Concessions, excepting the British Concession, represented by the Chairman of the British Municipal Council. The Chairman of the Tientsin General Chamber of Commerce (who also held the position of Honorary Treasurer to the Commission), and a representative of the Shipping Companies.

It was also laid down that the Chairman of the Commission should be the senior representative of foreign interests.

[illegible] or injury to the conservancy works previously referred to [illegible] been made good, the [illegible] also [illegible] Mr. de Rijke's [illegible] two cuttings, [illegible] of four bends lower down the river, and the [illegible] of abrupt variations in width by training.

Consequently upon a loan of Taels 250,000 granted by the Tientsin Provisional Government, the Board contracted for the excavation (by coolie labour) of the First Cutting, to a depth of 23 feet. Begun on the 21st October 1901 and completed in July 1902, this Cutting nearly a mile long, eliminated the Tientsin Bend, Match Factory Bend, Everlasting [illegible] so-called East Reach, and effected a saving of 1.3 miles [illegible] to be navigated.

During this period the Board acquired two steam launches, two Priestman Grab Dredgers, and a stationary Bucket Dredger of a capacity of 150 cubic metres per hour.

The floating of the Hai Ho Conservancy Commission's first loan - loan of 1902 for Taels 250,000.- was concurrent with the excavation (by coolie labor) of the Second Cutting, also to a depth of 23 feet, which was completed in [illegible] 1902. A little over a mile long, this cutting eliminated Double Bend, Arsenal Bend and [illegible] Bend, and reduced the length of the river by a little over three miles.

The excavation of these two cuttings to a depth of 23 feet below the surface of the soil, and to widths varying from 325 to [illegible] feet, necessitated the removal of approximately 2,200,000 cubic yards of earth.

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The result of these cuttings was that whereas during 1901 only 11 steamers were able to reach Tientsin Bund, 134 were enabled to do so during 1902.

In May and June 1903 the river was low and only the smaller steamers ventured up river. However, in August the ss."Lienshing" came up to Tientsin Bund on a draft of 11'8" and during the whole season (March to December) the total number of steamers that navigated the Hai Ho to Tientsin Bund was 333.

Besides training works, the Hai Ho Conservancy Board, in September, put in hand the excavation of another Cutting, but progress was slow as the contractor had difficulty in procuring sufficient labour. Meanwhile, the Board floated another loan of Taels 300,000 known as Loan B of 1903/4.

This third Cutting was completed at the end of June 1904 and opened to navigation on the 27th July. Nearly 2½ miles long, it did away with the three worst bends then remaining viz:- Lower Tombs Bend, the Pei-Tang-kou Bend, and the one at Handsome Point. The total excavation was nearly 2½ million square yards of earth, of which about 90% was dug out in three months; the largest number of coolies employed at one time being 15,000. The Cutting reduced the length of the river by 4½ miles, and a couple of days after it was opened the small ss."Tsingchi" made the trip from Tongku to Tientsin in 4 hours 10 minutes, or exactly one hour less than the previous record.

The effect of the opening of these three Cuttings was a further increase in the tidal range at Tientsin from about 1½ feet to 2½ feet.

The state of the Hai Ho, in conjunction with continued improvement works at various places carried out, will perhaps be best gauged from the fact that the number of steamers which navigated to Tientsin Bund, increased gradually year by year until during 1912 575 did it with a draft of under 12 ft. and 45 with drafts between 12 ft. and 14 ft. The annual record drafts carried up to Tientsin were as follows:- Hai ss." Lienshing" 11'8" 1904 ss."Taping" 11'9" 1905 ss."Antung" 12'7" 1907 ss."Lienshing" 13'6" 1908 ss."Tingsang" 13'0" 1909 ss. Chosan Maru" 12'6" 1911 ss."Yuan " 14'0" 1912 ss."Yi -ong" 13'10".
In connection with these figures however, it is now necessary to revert, to speak of investigations made respecting Taku Bar and of experiments made to improve its condition.

During the period of your Father's ... de Linde was engaged on improvement works in the Hai Ho, he had also been making interesting observations respecting Taku Bar and compiling statistical data, and it was doubtless under his advocacy that other specialised technical investigation was obtained. In March 1906 Mr. Lindeboom, an authority on sand pump dredgers, made a report based on such statistics as were then available, as to the best method of effecting the improvement of the navigable channel. In 1908, with the kind consent of Vice Admiral Sir Cyprian Bridge in command of the British China Squadron, Captain Dennis M.Smyth

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of H.M.S. "Rambler", carried out a survey of the waters in the vicinity of the Bar and submitted a report. In 1903 Herr Schellhoss made a report, and a year later the new Engineer-in-chief to the Board, Mr. G. Guiotton reported upon his findings. Then ensued the most comprehensive investigations as to the type of dredging plant that might be considered the most suitable. In 1905 a further survey of the Bay was made by the Chinese Customs Revenue Cruiser "Chmentiao" for purposes of comparison with that made by H.M.S. "Rambler".

At a meeting of Landrenters of the British Concession held on 26th June 1906 Mr. J. M. Dickinson, the Chairman of the British Municipal Council, after making a long and very able speech which comprised all historical and other aspects, moved that the Council be authorised to convey to the Board of the Hai Ho Conservancy an offer to provide the sum of Taels 450,000 being the amount required for initial expenses in connection with dredging plant. The resolution was carried, but as will be seen later, the Board was able to raise money on loan directly from the public.

Meanwhile experiments were made with existing units of the Board's plant, and in February 1906 under the personal supervision of Mr. T.F.D. Ferguson, the Commissioner of Customs, experiments were made by towing rolling rakes across the crest of the Bar. Incidentally although the Inspectorate General of Customs kindly offered to bear the whole expense of this experiment work, it was subsequently agreed that it should be divided equally between the Hai Ho Conservancy Commission and the Chinese Customs. The actual work begun early in July, shewed at the end of the season so much promise that the Board asked Mr. Ferguson to superintend further work during the ensuing year, and the Inspector General of Customs kindly consented to detach him accordingly. Although Mr. Ferguson was transferred to another port towards the end of 1906, the idea was persisted in for several more seasons, with beneficial results to shipping. Moreover, the lessons learnt from "raking" were of the greatest value both as regards indicating the direction of channel and in the choice or selection of type of dredger to be adopted.

Meantime, the Board was successful during 1909/1910 in floating Loan "C" for Taels 870,000 and besides four Steam Tugs with raking apparatus (which were used at Taku Bar in connection with the afore-mentioned work) several other important units were acquired consisting of:- a powerful Steam Tug, five Hopper Barges, a stationary Sand Pump with a capacity of 500 cubic metres per hour, pumping up to 5,000 feet distance, a Universal Dredger,(buckets or 20" suction) with a capacity of 500 cubic metres per hour, and 1000 feet of Floating Pipe of 20" diameter.

During the years 1902 to 1915 the spoil dredged at or near Tientsin by the 125 C.M. Bucket Dredger and the two Priestman Grabs was dumped back into the river, greatly to the detriment of navigation, and thereafter other means of disposal of spoil were devised. At first (1906/7) by boats of 12 cubic yards capacity punted along the Wei Tze creek to a large pond abutting on the British Municipal Extension Area, but this method proved too slow

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and too expensive. Then during 1908/9 by means of a pump erected on a wooden pontoon, spoil was pumped through pipes, partly into a large pond in the French Concession and partly to low lying land in the Belgian Concession, but still the quantity was comparatively small - at the most 80,000 cubic yards each year.

With the provision of the aforementioned 500 C.M. Sand Pumping Station and the Tug and Hopper Barges, the problem of disposing of dredged spoil was solved for many years. The filling up of the large pond in the French Concession to road vessel was completed; and the level of the British Recreation Ground was raised considerably; as also the low lying portion of the German Concession; While the raising of the level of practically the whole of the British Extra Mural Area by some six or seven feet occupied two decades. The system proved of mutual benefit to those concerned in the foreign Concessions and the Conservancy Board. To the former, since the price charged was very much lower than would have had to be paid for earth carted or brought in by wheel barrow coolies from the hinterland, and to the Conservancy Board in that the receipts from the sale of spoil covered the cost of operating the dredging plant in normal years. Moreover there was the added advantage that the filling-in did away with many foul ponds which were a nuisance by their being insanitary; being breeding places of mosquitoes, and the habitations of hosts of noisy frogs.

Early in 1911 the aforementioned 500 C.M. Universal Dredger was placed in a closed dock (furnished with supply pipes and sluices) near to the village of Chao Fei Chuang, and thereafter using her buckets for cutting and lifting and her mixing chamber and pumps to pump the spoil through pipes on to prepared sites on either hand, excavated her way through what became called the Fourth Cutting - she being kept afloat by further water as required being let into the canal in process of being cut. However, the output was disappointingly slow in consequence of large quantities of stiff reed roots encountered over the first few hundred feet and the continual choking of the discharge pipe. By the end of 1912, the dredger had completed two-thirds of the total excavation; the output being double that of the previous year. The Cutting was opened to traffic on the 16th July 1913. Two miles and a third long, it did away with three almost 90 degrees Bends; shortened the distance previously traversed by steamers by a little over 5½ miles, and caused an increase in the tidal range in the river immediately by 6", but which increased in subsequent years. The total excavation was nearly three and a half million square yards, and the ratio of cost (excluding expropriation of land and compensation for houses and graves) was only about 60% of the price paid for excavating the Third Cutting by manual labor, nearly a decade previously.

Reversion is again necessary to bring in the steps taken to keep the Canal No open during the winter months, in response to an initial enquiry made by the Committee of the General Chamber of Commerce in May 1911. Besides a lengthy report submitted by Mr. J.C. Vliegenthart, then Engineer

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opinion received from Mr. W. F. Tyler, Coast Inspector; the Chairman of the Conservancy Board, Herr. H.Knipping, arranged with the German Foreign Office for Herr Liese (who had during the preceding decade been in charge of the Ice-breaking on the River Elbe) to come out to stay through the Winter season of 1911/2. In April 1912 the Tientsin General Chamber of Commerce requested the Hai Ho Conservancy Board to make the attempt to keep the river entrance to Tongku open during the Winter months by means of ice breakers in accordance with Herr Liese's suggestions.

The Board proceeded to order two Ice-breakers and concurrently to raise another loan of Taels 290,000 known as Loan D 1912/4. The craft, one 85 feet long of 200 I.H.P., and the other 120 feet long of 700 I.H.P. were put into service during the Winter of 1913/4. That season, with the exception of about a week in the last half of December, was an exceptionally mild one and steamers could have come to Tientsin without difficulty at any time. Actually the first steamer arrived at the Bund on the 22nd January 1914, and thereafter normal traffic was resumed.

Resuming the tale respecting Taku Bar; although as already mentioned the attempts during 1906 to 1912 to effect a deeper channel by means of rakes towed by steam tugs, were beneficial to shipping and of the greatest value in respect of investigation and experience, it was conclusively proved that "raking" offered no permanent solution of the complex problem of Taku Bar, although admittedly an interesting and temporary expedient of great utility in the absence of dredging plant etc.

The craft selected, having a suction capacity of 700 cubic metres per hour and a pumping capacity of 800 cubic metres per hour, arrived in March 1914, and her trials having proved satisfactory, she was forthwith put into service. The work was to dredge on the ebb tide, day and night, and to pump the material back to the sea through discharge pipes 70 feet in length, and it proved that all varieties of soil found on the Bar (whether mud, sand or clay) could be effectually pumped by dragging the suction pipe and stirring the soil by means of water jets working at a pressure of 30/45 lbs. The deepening of the Bar channel progressed satisfactorily, and in June 1915 the ss."Woman" crossed the Bar drawing 15'6", which was a record.

In 1914 another ice-breaker 120 feet long but of greater power - 800 I.H.P. - was acquired, and during the following Winter season besides all three craft being very actively engaged, a fourth boat was chartered and used principally for the conveyance of pilots. No difficulty was experienced up to the 10th January 1915, but during the ensuing month the temperature was exceptionally low and prevalent winds were from the east, which had the effect of packing the sea ice along the entire coast. The ice field extended over 60 miles out to sea, and it was as much as 24 feet thick in places. It was not unusual for the ice to be packed into the river mouth by occasional Easterly winds, but it was very rare

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for the ice to extend so far that no open water was visible beyond it. The ice driven in by an East wind generally moves out when the wind changes West, but no wind could affect such an extensive ice field as was formed that winter.

A fourth ice-breaker of 122 feet in length and of still greater power - 900 I.H.P. - was acquired and added to service during the winter of 1915/6. That season was an exceptionally mild one, and the few vessels that came to the port experienced no difficulty or delay, excepting on the 6th January 1916 when two vessels were delayed by a couple of hours by the jamming of ice brought in by the flood tide. Tugs with lighters in tow could operate throughout the month, when preceded by an ice breaker.

The Winter of 1916/7 was of considerably over average severity, according to temperature records. A spell of exceptionally severe cold supervened during the last week of December, and was followed by a series of Easterly gales lasting three weeks, causing ice conditions in the Gulf of Pechihli similar to those which pertained during the Winter of 1913/4. Although the ice breakers could traverse the river between Tientsin and Tongku in from 18 to 20 hours when the ice was at its worst, the steamers "Pengtien" and "Kwechow" were ice-bound in the river for three weeks, but the reason for this was that their engines could not be worked for fear of damage to the propellors - which require to be of steel, to work in ice.

Another great Flood, that of the year 1917, rivalled the inundation of the year 1890. The primary cause was an exceptionally heavy inrush of sand from the Ying Ting Ho in July, which caused the Hai Ho to shoal in places from 7 to 9 feet in 48 hours, thereby materially reducing the discharge of the main flow outlet. This was followed by the bursting of the Yung Ting Ho dykes at several points and the flooding of the surrounding country. In August a still more powerful freshet came through from the tributaries Ta Ching Ho and Tze Ya Ho, and caused an alarming rise in the water level above Tientsin City. The silt deposited in the Hai Ho in July was rapidly scoured out, and the output of that river gradually reached the record-figure of 33,000 cubic feet per second.

Some 16,000 square miles of the most populous portion of the Chihli province, that between Pao-ting-fu and Tientsin were flooded; the value of the crops destroyed was enormous, and unnumerable villages were ruined. It is probable that the water would have made its way through Tientsin City and over the Bunds of the Foreign Concession, had not the South dyke of the Nan Yun Ho given away at several points between Yang-liu-ching and Liang-wang-chuang. The waters thus released carried away the main line of the Tientsin-Pukow Railway and flooded the greater part of the Foreign Concessions, before measures for their protection could be carried out. In fact only the strip of land along the Bunds of about 300/400 yards wide escaped inundation, by the timely cutting of the embankment of the branch line of the Tientsin-Pukow Railway between Liang-Wang-Chuang and Chen-tang-chuang.

As compared with the elevation of the Bund Wills - approximately 18.5 feet Taku Datum, the water over the Western portion of the Concessions

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reached a level of 15.5 feet T.D. before commencing to subside, whilst the level of the Hai Ho opposite the British Concession reached 16.2 feet T.D.

The extraordinary freshets and floods just referred to carried down to Taku Bar more than 12 million cubic yards of spoil, and caused shoaling there to the extent of about 7 feet. When the great bulk of the silt had ceased to come down, the Channel being obstructed, the current flowing over the Bar as over a weir, accommodated itself to a large depression, which offered sufficient room for the passage to the sea of the prolonged outrush of water from the Hai Ho and the flooded areas. Shipping made use of the depression referred to as a navigable channel, but the Dredging Plant made a fairly good channel in one season, permitting of steamers crossing the Bar with a draft of about 14 feet.

During floods of the year 1912 the East dam of the Pei Yun Ho gave way at Li sui chan, North-East of Peking. The local authorities effected repairs during the following winter, but the dam was broken again by the freshet of 1913 and no further attempt was made to repair it. The result was that the whole of the fresh water supply from the Pei Yun Ho was diverted to the Chien Kan Ho which has its outlet to the sea near Pei tang, about 15 miles North of Taku. The evil effect on the Hai Ho of this diversion was not only the loss of so large a proportion of the fresh water supply during dry seasons a serious matter, but more serious still was the removal of the only barrier that had existed to the inflow of sand from the Yung Ting Ho. After much correspondence and discussion and no doubt under the impetus of the disastrous effects of the floods of 1917, the Chinese Government agreed to the Hai Ho Conservancy Board's proposals and the Commission for the improvement of the River System of Chihli (Chihli River Commission) was appointed in March 1918 under the presidency of Mr. Hsiung Hsi Ling, Director General of Flood Relief and Conservancy. To this Commission the following programme of works was entrusted:-

(a) the reversion of the Pei Yun Ho to its old course by means of a cutting at Niu Mu Yun

(b) the elimination of a loop in the Pei Yun Ho opposite Tientsin City by a cutting (afterwards called the Cathedral Cutting)

(c) the rectification of the outlet of the Nan Yun Ho into the Pei Yun Ho by a cutting (afterwards called the Nan Yung Ho Cutting)

(d) the making of such survey and collection of such data as should be necessary for the preparation of a grand scheme for the relief of floods and amelioration of the rivers of the province of Chihli.

B and C were completed in accordance with the plans of the Hai Ho Conservancy and under the supervision of its Engineer-in-chief Mr.M. Pincione in 1918 and 1919 respectively. And the improved propagation of the flood tide of the Hai Ho since the completion

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of these cuttings, fulfilled the most sanguine expectations.

One of the first works taken into consideration by the Chihli River Commission was the building during 1918 of an earth dyke on the Western and Southern outskirts of Tientsin City and the Foreign concessions, for their protection against subsequent floods. Improvement was effected during 1920 by the building of a new dyke further to the West which enclosed a much greater area under protection, including the Race Course of Chihli, the Nankai University and the property of the Tientsin Race Club, also several villages. The South end of this outer dyke joined the embankment carrying the branch line of the Tientsin Pukow Railway which has its terminus on the bank of the Hai Ho at Chen tang chuang. Eventually in 1924 this latter embankment was improved, bringing the top level of the dyke throughout its length to an elevation of 19½ feet Taku Datum.

Besides putting in hand improvements to the Hsin Kai Ho, a defluent of the Pei Yun Ho, situated about a mile above the Cathedral Cutting, also the Ma Chang Canal, the Commission effected the partial Reversion of the Chao Pai Ho into the Pei Yun Ho, by a cutting between Su Chuang and Ping Chia tuan, and a series of regulators to facilitate the diversion of water into the new channel.

The outbreak of Civil war dictated postponement of the commencement of the works until the Spring of 1923, and after set backs occasioned by subsequent flooding and great difficulties in connection with the transportation of materials, and especially of the steel gates, etc., for the regulators, the Whole work was completed by August 1925.

Meanwhile other improvement work was carried out, including repairs to the breaches of the Yung Ting Ho, and eventually after completing the survey and collecting all other data requisite, the Commission submitted a report. They estimated that expenditure of $56,000,000 would in their opinion greatly improve the flood conditions of the Northern system of rivers in Chihli, and that approximately a further $40,000,000 would be required for the improvement of the Southern system.

Resuming the story of the achievements of the Hai Ho Conservancy Board, it is necessary to mention that although by the end of 1920 the 500 C.M.Suction Dredger had succeeded in dredging a channel across Taku Bar, which allowed steamers drawing 15 to 16 feet tocross at ordinary high water; the handicap still remained that the frequency of the sea being disturbed precluded the use of hopper barges for the better disposal of spoil. Therefore in 1919 the Board ordered from Renfrew a Suction Hopper Dredger of the trailing type, which could discharge into her own hopper, or to the stream through pipes projecting 75 feet overboard. About 236 feet in length, 42 feet in breadth, and having a suction capacity of 500 cubic metres per hour, the Dredger arrived in June 1921 and after preparation of outfit, commenced to work on the Bar.

The final major work of improvement of the Hai Ho, put in hand by the Board, was that called the Tombs Bend Cutting, though as it replaced the Second Cutting (opened in 1902) the latter continue

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Commenced in June 1921, and for the most part excavated by the same Universal Dredger that cut the Fourth Cutting 1911/3, the work was completed and the new channel opened to traffic in October 1923. The series of excavations, in effect a rectification of the old Second Cutting, about 325 feet in width over a length of nearly two miles, involved the removal of about 2½ million cubic yards of earth. Besides curves which had formed at the ends of the old cutting, the very acute upper Tombs bend and the lower Tombs Bend were eliminated; and the saving in the distance on the river effected was nearly a mile.

The work was financed by a temporary loan of Taels 200,000 granted by the Chinese Customs, which was repaid in 1922.

At the request of the Board, Mr. F. Fincione submitted a further improvement scheme under the caption "Report on the future of the River Hai Ho and its approaches", and in order to obtain further expert opinion thereon; in addition to asking Mr.A. de Linde to report on the scheme for a permanent channel over Taku Bar; the Board invited M. Louis Forrier, Engineer-in-chief of Ponts et Chaussees of France, to come to Tientsin to study the proposals and report. In the latter's report presented in 1923, he recommended that on account of its supreme importance to the future of Tientsin, the Commission should, above all, devote its resources and efforts to making and deepening a new channel over Taku Bar, and confine itself in the meantime to carrying out such improvement works on the Hai Ho, useful but much less urgent, as its funds permit. As previous efforts at the Bar had been handicapped owing to silt pouring in from the mud banks, it was intended to build dykes on the North Bank and on either side of the projected new channel through the South Flats.

Whilst the foregoing scheme was under consideration, the Board came to an arrangement with the British Municipal Council aimed at accelerating the rate of supply of spoil to be dredged from the river, with a view to completion of the raising of the level of the British Extra Mural area (for which about 5 million cubic yards of earth was still required) within the ensuing five years.

Under this arrangement, the Council furnished the cost of a 300 C.H. Stationary Bucket Dredger, a twin-screw Tug and two more steel Hopper Barges; and as further consideration the Board reduced its price for supplying spoil from Taels 12.00 per 100 cubic yards to Tls.10.00

Another important item was that the Board was entrusted by the Consular Body with a scheme for a new Bridge over the Hai Ho, connecting the French and other concessions on the right bank, with the ex-Russian Concession and adjoining East Railway Station on the left bank of the river. ork was commenced in 1924 concurrently with the floating of the Hai-Ho Bridge Loan for Taels 500,000 and to provide for interest, amortisation, etc., Bridge dues were levied on all imports and exports of the port, calculated @2% of the Customs duties paid in respect of goods imported and exported. Placed between the Western end of Rue de France and the Eastern end of Taku Road, and called the new International Bridge it superseded the International Bridge

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was repaid partly in 192 9 and the balance in 1931. The old Bridge was during 1928 dismantled and placed across the Hai Ho close to the junction with the Pei Yun Ho, in replacement of an old camel-backed bridge that had been washed away by a flood some time previously.

The Commission's fleet of ice-breakers was increased to six, by the addition of one towards the end of 1923, 97½ ft.long, 20 ft. beam, 5'3" draft, and another in 1925 98 ft.long, 23 ft.beam,7ft. draft - both being fitted with Light vessel apparatus.

Eventually Mr. Pincione's new scheme of the Taku Bar Permanent Channel, to which Mr. Perrier had given his full support, was adopted by the Board, and in 1926 concurrently with the progress of the work of building dykes on the North Bank and on either side of the projected new channel through the South Flats, the Commission floated its Loan E for Taels 1,250,000.

The dykes were built, and the first cut with the aforementioned Universal Dredger was commenced in the Autumn of 1927 and completed in 1928. In the meantime, Mr. Pincione was succeeded by Mr.Jean A.Hardel as Engineer-in-chief, who arrived during the Summer of 1928. Copies of the Hai Ho Commission's reports, as well as of the Final Report of the Chihli River Commission of 1926, had been sent to him; also before leaving France he had been in touch with Mr.Louis Perrier; so that before his arrival Mr. Hardel had gained a cursory idea of the conditions with which he would be confronted.

Incidentally within a few weeks of his arrival, Mr.Hardel submitted a lengthy report on the general conditions affecting the Hai Ho, with an outline of both a temporary and a radical improvement scheme. This came to the conclusion that the main basis of any final grand scheme, of any comprehensive programme, solving the flood problem as well as the problem of the Hai Ho, was the use of the water in an Irrigation System. Instead of the provision of a direct outlet to the sea of the Yung Ting Ho, as suggested by the Chihli River Commission in its final report; Mr. Hardel advocated as a temporary measure the diversion of the waters of the Yung Ting Ho, near to Ta-kou-chiao, via existing defluent streams into an extensive lake called the Lasi Tion situate some 20 miles East of Paotingfu and about 60 miles West-South-West of Tientsin. And that after allowing for sedimentation, the clarified or partially clarified water be trained into the Ta Ching Ho for the eventual benefit of the Hai Ho. Mr. Hardel's idea of a radical scheme embraced the provision of settling basins alongside the tributaries of the Yung Ting Ho in the vicinity of the foothills, though in both cases he realised that the sphere concerned lay outside of the jurisdiction of the Hai Ho Commission.

Meanwhile, besides the ravages of teredo worms, which literally honey-combed the piles, etc. in the new dykes on the North Bank and the South Flats; an extraordinary volume of silt from the Yung Ting Ho which first caused bad shoaling throughout the upper portion of the Hai Ho during the early Autumn of 1928 (and caused a reduction in the depth of the river at that portion to about 10 foot at ordinary high water, and eventually became rolled out to Taku Bar the next year; appears to have dictated virtually a stoppage of work on the projected New Channel.

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Before quoting a recapitulation of the achievements of the Hai Ho Conservancy Commission, contained in their Report for the year 1929, it would perhaps be interesting to insert a copy of a letter dated 1st August 1904 from Mr. G. Detring, Commissioner of Customs, to Mr. J.M. Dickinson, Chairman of the Tientsin General Chamber of Commerce.

It reads as follows:-

"Some time ago you suggested the compilation of figures showing the detention experienced by the Shipping in consequence of the existence of the Taku Bar. I understand that this compilation was meant to gain a base for establishing an approximate estimate of the charges which the Bar imposes upon the trade of the Port. I have reviewed the detention in the case of ten steamers, which I believe were specially designed and built for the carrying trade between Shanghai and Tientsin in order to minimise the obstructions encountered by navigation at the Bar and in the Pei Ho; during the five normal years 1898/9 and 1901/3 - the year 1900 of Boxer memory being left out as an abnormal one. I find that the Ten selected steamers made in the course of five years 939 round trips between Shanghai and Tientsin, experiencing on these voyages 1194 days detention at the Taku Bar - or say an average detention of 240 days and missing, therefore, collectively 24 trips a year. The average yearly charges on Trade incurred owing to the detention of the selection 10 steamers, is estimated as follows:-

Portage expenses 2 40 days	Tls.	48,000
Lighterage on cargo transhipped to reduce steamers draft from 12 feet to 10 feet		60,000
Loss of 24 round trips, at the rate of Tls.3,000 for freight per trip		72,000
Total yearly average charges on Trade		Tls.180,000

Taking the gross tonnage entered at the Customs House during the said five years, as averaging say 746,000 tons a year, it results from the example of the 10 selected steamers, that the total charges on trade amount to at least Taels 650,000 a year."

The recapitulation of the achievements of the Hai Ho Conservancy Commission from 1898 to 1929, was accompanied by several graphs, but omitting the reference to the graphs, reads as follows:-

The depth of water in Tientsin Harbour at Ordinary High Water in 1898 was 6 feet or less. After the closing of the lateral canals the depth was 7½ foot. After the making of the first three Cuttings it was 12½ feet, and after completion of the Fourth and Cathedral Cuttings it was 16 feet.

In 1898 the rise and fall of tide in Tientsin Harbour was not appreciable but after completion of the aforementioned works it was respectively:- 1½ feet, 3½ feet and 7 feet.

The cross sections throughout the Hai Ho have practically doubled since 1898, while its length has been reduced by the making of the first four named Cuttings, and the rectification of the Second Cutting by the Tombs Cutting, from 56 statute miles (49 nautical miles) to 41 statute miles (35 nautical miles).

The work of the Commission has not only resulted in the achievement of a more or less gradual improvement, but has in fact proved an almost uninterrupted fight against natural forces under adverse circumstances;

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a fight which has been normally successful over periods embracing some years and thereafter followed by an insuperable inrush of silt, which in the space of a few days, nullified or reduced the improvement patiently realised over years. On the whole, however, the improvement has been extremely satisfactory.

Taku Bar was practically at the level of the Taku Datum in 1903-1904 thus the depth at average high water was about 8 feet, and the Channel wandered from one direction to another. The Fergusson Baking system improved the channel until it reached a depth of 5½ feet T.D. (13½ feet below average high water) in 1912, when a very heavy freshet brought down an enormous amount of sand and reduced the depth again to Taku Datum (8 feet below average high water).

However, work was immediately started on a channel in a new direction and much more rapid results were obtained owing to the beneficial effects of the first three Cuttings, which had been made in the river some years previously, and of the Fourth Cutting which was completed in July 1913. A depth of 4½ feet T.D. was thus regained in 1915. The work of the Commission's Dredger "Chung Hua" gradually increased this depth to such an extent that the channel, during a short period in 1917, was good for 9'4" T.D. 2 (17'4" depth at average high water). The exceptional freshets of 1917 then again brought down an enormous quantity of silt. However, due to the general improvement of the river, the effect on the Bar was not so serious as it was in 1912, when as already mentioned, the depth was reduced to Taku Datum. From 1917 onwards the depth again increased gradually until it attained 10½ feet T.D. in the Summer of 1924; but two heavy freshets of that and the next year had their shoaling effect. In consequence of operations carried out by means of the new Trailing Hopper Dredger "Kuei Li" and of the enhanced effect of the Cuttings due to the addition of the Cathedral and Tombs Bend cuttings, these tremendous inrushes of silt can be more successfully counteracted than previously. The signalled depth does not go below - 5 ft. T.D. (14 feet below average high water) and the depth is improved again during the following years. The heavy freshet of 1928 had little effect on the channel the depth not being reduced to less than 7 feet T.D. (12' below average high water).

The particulars included in the appended Comparison of Annual Arrivals of Shipping, which from the year 1908 includes the Annual Record Draught carried to Tientsin Bund, afford good indication of the improvements obtained, though some of the yearly maximum drafts were attained on occasions when the tide or state of the river was particularly favourable. However, although the comparison return does not include sufficient detail it should be mentioned that whereas the 10 selected steamers referred to by the Commissioner of Customs in his letter of 1st August 1904 carried an average of about 1,000 tons, these during the period of this review were replaced by new steamers designed and built to carry 2,000 tons and in some cases 2,100 tons.

A further undertaking of the Commission has been the maintenance of free access to the river harbours during winter by means of ice-breakers operations. Prior to 1913 the Port was completely closed each year for a period varying between 5 and 90 days according to the mildness or severity of the weather conditions that prevailed. Ice-breaking operations were commenced in December 1913, and during the ensuing decade the Port was closed on only three occasions. Since 1923 the Commission has with its [illegible] six, been

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enabled to keep both the river and the Bar open to continuous navigation during the hardest of Winters. Moreover, navigation has been further assisted by assigning two of the ice-breakers to act as light ship and Pilot's tender respectively.

Undoubtedly the danger of floods to Tientsin has been reduced year by year by the improvements in the river, including the largely increased cross sections. The discharge capacity of the Hai Ho having become largely increased, more water can be delivered by the tributaries, and therefore the danger of flood along the courses of those streams has been reduced greatly. Hence, the deepening of the Hai Ho bed has not only contributed towards the development of traffic to Tientsin Harbour, but has also lessened the effects of floods throughout the province.

Having shown the improvements effected since 1898, it will be interesting to also show the cost of improving and maintaining the waterway from the sea to Tientsin during the 32 years 1898 to 1929, viz:-

River dues (at 1% of Customs duties 1898-1901 " 2% 1901-1903, at 3% 1903-1908) Shipping tax (@ 4% 1909-1929 (at 10 candarins per ton on ships which cross the Bar, & 5 candarins per ton on ships which remained outside the Bar		Tls.5,640,879
Loans		2,724,018
Chinese Government Grants		3,310,000
Miscellaneous (including sale of dredged spoil)		1,771,125
		1,692,861.-
		Tls.15,138,883.-
from which must be deducted the following:-		
Redemption of Loans		1,615,300
Loan to Build'g Account		100,000
Plant 1,340,047 Property 285,284		1,932,302
Stores etc. 88,309 Debtors 218,875		115,184
Reserve Fund		253,779
Bank Balances		106,689
		Tls.4,123,254

leaving the net cost at Taels 11,015,629 which divided by 32 shews an average annual net cost of Taels 344,238.

Having recognised the determination of the foreign community of Tientsin, led by the British Municipal Council during the Nineties, to safeguard the interests of Tientsin and its trade, it will perhaps be interesting to reflect upon, or attempt a rough comparison of the figures just previously quoted.

In his estimate of the total charges on trade through the detention of ships at the Bar, the Commissioner of Customs overlooked the fact that a proportion of the annual tonnage entered at the Custom House consisted of ocean-going vessels whose destination or point of call was the open roadstead outside the Bar, so that the figure should not have been set as high as Taels 650,000. However, to take his estimate of the yearly average charge on trade in respect of the 16 selected steamers Taels 180,000 and divide it by the yearly average number of round trips actually made, 188 - taels 957 may be expressed as loss per trip. For the purpose of comparison we will adopt that ratio, and as it would be

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impracticable (if not impossible) to assess subsequent rises in expenses and freight rates, we will ignore them, also the fact that those coasting vessels referred to, were placed during later years by newsteamers designed and built to carry 2,000 tons and in some cases 2,500 tons. While during the years 1903 to 1906 several ships crossed the Bar and reached Tientsin with a draft of nearly 12 feet, this may be attributed to luck in getting over on a high Spring tide; and certainly the improved state of the river was very beneficial to all ships that came to Tientsin. The greater proportion of ships however, had to lighten outside the Bar, and undoubtedly several had to suffer detention at times of Neap tides. A draft of 12 feet across the Bar was permissable during the Summer and towards the close of 1907, also at ordinary high water thereafter. Counting accordingly the appended Comparison of shipping shews that during the 22 years 1908 to 1929, 22,732 ships crossed Taku Bar, of which 19,856 passed up the river to Tientsin. Assuming that practically all had a draft of at least 12 feet, and to remain on the conservative side, we find that 19550 x Tls.957 equals Tls.18,709,350. Thus it is clearly manifest that the net cost of the Improvements effected by the Hai Ho Conservancy Commission over the 32 years 1898 to 1929 (Taels 11,015,629) meant not only a huge saving in the interests of Tientsin, and that from the Winter of 1913, navigation during Winter months was possible (a facility not anticipated when the Commissioner of Customs wrote his letter of 1st August 1904) but encouraged and permitted the enormous increase in its trade (by nearly four times) during the aforementioned period of 32 years.

The Kinchono scheme of a Permanent Channel across Taku Bar was abandoned, and in 1931 onwards the sheet piles and stone rubble removed from the dykes were largely used to make an Ice dyke on the North Flat, which in subsequent Winter seasons proved of great value in preventing large quantities of ice which formed on the North Flat from entering the channel.

The Winter of 1930/1 was held to be probably the severest experienced in the history of the Commission's Ice-breaking operations. On the 4th February 1931 a North-easterly gale set in and was followed by continuous easterly winds. These brought an enormous amount of drift ice to the Bar and an immense ice field was formed outside the river mouth. This ice field eventually extended 70 miles out to sea, and the ice piled up to a thickness of 10 feet. Ships could only move in convoy and the three large ice-breakers were actively employed in the channel. These difficulties continued for three weeks.

During the following Autumn, shoaling of the upper reaches of the river was again experienced, and the permissable draught had to be reduced to 12 feet.

Meanwhile, the Chinese organisation that succeeded the Chihli River Commission was working on a palliative scheme, to rid the Hai Ho of the silt carried by the Yung Ting Ho. This involved the construction of a barrage including a boat lock in the Pei Yun Ho., a little below the confluence of the Yung Ting Ho with the Pei Yun Ho; the excavation of a channel through the Yung Ting Ho delta; and opposite the outlet of this channel on the left bank of the Pei Yun Ho the construction of a Regulator consisting of sluice gates. It was intended that each freshet from the Yung Ting Ho would be diverted across the Pei Yun Ho through the Regulator into settling basins, and that the clarified water would be led via the Hsin Kai Ho or the lower reach of the Pei Yun Ho into the Hai Ho. The owners of the land occupied by the settling basins were willing to [illegible]

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It was estimated that the settling basins would become filled in over a period of 18 years.

These works were completed by March 1932, but owing to a misunderstanding with the Native land owners concerned, the Spring freshet could not be diverted into the settling basins. Trouble with other natives in the Yung Ting Ho delta interfered with the operation of the diversion of the Summer freshets, with the result that the Hai Ho was again adversely affected. In fact, interference from natives in one district or another, also sabotage, appears to have been an annual occurrence thereafter.

A summary of notes respecting 1933 shows that the year opened with great hopes for the steady improvement of the navigability of the river and Bar Channel provided that the only doubtful factor - the diversion of the Spring freshets - could be satisfactorily solved that although this was successfully overcome, two successive disasters visited the Port from unexpected quarters, undid the work which had been carried out in anticipation of the normal diversion of the Summer freshets and rendered the river temporarily unnavigable by steamers; and that it was possible by November to restore to the Hai Ho a navigable draught of 17 feet, owing to the steady and prolonged spate in the eastern tributaries, and to intensive dredging operations.

The outstanding portion of the Commission's Loan D of 1912/4, was completely redeemed in 1934/4 and December of that year saw the completion of the hydraulic filling of the British Extra Mural Area. Commenced in August 1916, the total amount of filling supplied in raising the level of the Area from an elevation of about 10 feet Taku Datum to about 17 feet T.D. was about 4 million cubic yards.

The outstanding portion of the Commission's Loan C of 1909/11 was completely redeemed in 1935; while as at the 1st January 1935 the Commission's Loan A of 1926 for Taels 1250,000 bearing interest @ 7% p.a. was converted to a loan of $1,810,000 Chinese currency, bearing interest @ 5% p.a.

Compared with the previous few years, the Hai Ho during 1935 experienced quite a favourable season. No serious floods occurred; the silting could be dealt with by the Commission's dredging plant, and navigation continued practically uninterrupted during the whole year, although with rather too shallow a draft for the larger type of steamer then carrying the trade of the port. The palliative works in respect of the Yung Ting Ho on which a large sum of money was expended, do not give any guarantee for the maintenance of the navigability of the Hai Ho They do under certain limited conditions mitigate the shoalings, which would otherwise bi-annually be caused by the silt-laden waters of the Yung Ting Ho, but only for this tributary and the Tsai Han Ho are they of any assistance. The southern tributaries, which this year caused most of the silting in Mountain Harbour are entirely uncontrolled and will in a not distant future, menace the Hai Ho in a manner similar to the Yung Ting Ho.

No revenue was forthcoming in respect of the spoil dredged from the river and pumped to low lying ground adjoining the foreign concessions

Whereas the Winter of 1934/5 was the mildest in the history of the Commission's ice-breaking operations, the onset of the 1935/6 season was exceptionally early and severe. On the night of 8th December 1935 a blow from the North-West carried the water out of the Gulf of Pechili

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and the temperature soon fell as low as 2 degrees Fahr. Much ice accumulated in the river and on the Bar and although the ice-breakers were hastily sent out, continued winds from the North-West so reduced the tidal range that there was insufficient current to evacuate the ice after it had been broken. Ice-jams, caused by the reformation of the broken ice in the bends occurred which hampered the movements of tugs and lighters and steamers were held up more by the reduction of depth than by actual ice obstructions. The congestion was cleared and normal traffic resumed on the 14th December. After a respite of a few days, an exceptionally heavy accumulation of bank-ice from the North Flat moved across the fairway at a time when a number of steamers, and tugs with lighters, were leaving the river mouth. Although this convoy was escorted by three ice-breakers, the steamers "Hunan" and "Yatshing" a tug with two lighters as well as one of the ice-breakers were carried on to the South Flat. Every effort was made by the other two ice-breakers to assist the stranded vessels, but the thickness of the ice, coupled with falling water, defeated their endeavours. There followed another blow from the North-West with consequent low tides, and on the 18th December, the steamers "Chefoo Maru" "Tingsang" and "Shuntion" grounded in the Bar channel owing to insufficient water, but on the following day they crossed the Bar and arrived at Tongku. The wind veered to the North-East on the 20th December; a signalled depth of 16'3" at high water ensued, and enabled the vessels stranded on the South Flat to be refloated. The next day a strong North-Westerly wind with severe cold set in once again. Ice conditions became aggravated and the steamers "Chengtu" "Hanchang" "Kitto Maru" "Peikong" and "Shima Maru" grounded. Calm set in on the 24th and there being a depth of 15 feet at high water, the five steamers were freed. Another North-West blow occurred on the 28th and the ss."Yekishin Maru" driven on to the South ~~Kax~~ Bank by thick sheet ice which had come down from Peitang. An attempt with three ice-breakers to tow her off was made, but met with no success. Ice conditions became worse on the following day, with strong N.W. wind and severe cold, causing the Taku Lightship to leave her moorings; the "Yekishin Maru" to be forced further on to the South Bank and two lighters to be carried out to sea. The Lightship returned to her position that night while the tug "Jungfa" accompanied by an ice-breaker, eventually located the two lighters at a distance of about 22 miles from the Taku lightship and brought them safely back to Taku on the 1st January 1936. As the very adverse conditions continued, the Commission chartered the very powerful sea-going ice-breaker "Christine Koller" for the period from the 10th to the 20th February, whose captain in the course of his detailed report wrote:- "The ice conditions have been very difficult; the current and wind have packed the ice so hard that only steamers of strong power were able to follow his track. And that during night - work it was almost impossible, as the ice was drifting all the time and navigators on steamers were unable to see the track. In some places where the ice had packed it was from 6 feet to 8 feet thick."
It was not until the 1st March that conditions became more favourable and not until the very exceptionally late date of the 15th March that ice signals were finally discontinued. The season was the most severe experienced since ice-breaking operations were commenced in December 1917, and during its course all the Commission' ice breakers as well as a number of steamers suffered damage.

In concluding their report for 1936, the Engineering Department of the Conservancy said that the Hai Ho had again experienced quite a favourable year. No serious floods occurred; the silting was kept in check by the Commission's dredging plant; and excepting the delays caused by the unusually severe ice conditions afore referred to navigation continued during the [illegible]

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The hostilities that broke out between the Japanese Troops and the local Chinese Pao An Tui caused a temporary suspension of Conservancy operations between the 29th July and the 3rd August 1937. Later, at the request of the Chinese Works Administration concerned, the barrage and regulator works for the diversion of freshets from the Yung Ting Ho were temporarily taken over by the Hai Ho Conservancy Commission on the 10th September.

Thanks to the energetic and effective steps taken by the Peace Preservation Committee and the Japanese Authorities, as well as to the experienced advice of Mr. P. E. Muller, Chief Conservancy Engineer; Tientsin City and the Foreign Concessions were saved from what must otherwise have been a disastrous flooding. The circumstances attending the floods that took place in the Autumn, were different from any hitherto experienced. Torrential rains fell late in August, but the only rivers that appeared to be affected were the Yung Ting Ho and the Pei Yun Ho, both of which came down in moderate freshet. The Western and Southern tributaries were strangely quiet. Owing to the hostilities prevailing it was not possible to maintain the usual hydrometric stations on the various rivers, so that no anticipatory appreciation of freshet conditions or preparations for floods, could be made. Towards the end of September, flooding was apparent outside the Outer Protection Dyke, and the Authorities were advised to keep closed the gates in that Dyke, as the flood water was making ingress upon the creeks and low-lying areas in the district lying to the West of the Tientsin Race Club's grounds. It was established that this inundation originated from breaches made for defence purposes by Chinese troops in the left bank of the Machang Canal. On the 27th September it was believed that as a result of the breaching of the banks of the Nan Yun Ho and of the Tze Ya Ho, a tract of country some 160 miles by 120 miles extending between these two rivers from Te chow to Tientsin was inundated.

The flood water was finding its way into the Hai Ho through a breach purposely made in the lower reach of the Tze Ya Ho to relieve Tientsin from this water and through the Nan Yun Ho by overflowing the low left bank of that river and thereby regaining its bed. The water in the Nan Yun Ho behind Tientsin City had risen to a level which was almost awash with the top of the South Dyke, the last defence for Tientsin. Slight breaches occurred in this Dyke; but owing to the vigilance and prompt action of those guarding the dyke, the breaches were repaired before they could establish themselves. The situation was aggravated on the 28th September by a break that took place in the right bank of the Nan Yun Ho, two miles South of Tu Liu chen. This break was said to have quickly extended to a width of about 440 yards, so that a very large volume of water was added to the already inundated country outside the Outer protection dyke, which as already mentioned guards the West and South of Tientsin. During the following fortnight the position was highly critical. Whilst the danger of a break occurring in the Nan Yun Ho dyke behind the City remained, the water outside the outer protection dyke continued to rise. The situation was all hte more grave owing to th absence of definite knowledge of the floods in the area of the Southern tributaries. It was not until the 22nd October that an equilibrium becam established between the flood accumulation outside the Outer Protection Dyke and the drain off of that water into the Hai Ho at the Fourth Cutting. Fortunately, the Outer Protection Dyke, which had been severely tried, stood the protracted strain from the water outside of it, and by the middle of November, the water had fallen to a level which ensured security.

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Tientsin Harbour and the Hai Ho at the end of the year (1937) were in a satisfactory condition as far as navigation was concerned. The Bar channel was a s usual after a flood-year badly silted and would require special efforts the next year to restore its previous state of navigability.

As a result of negotiations made through the Consular and Diplomatic Bodies the Inspector General of Customs authorised the Commissioner of Customs, early in January 1938, (a) to pay to the Commission the Chinese Government grant as from the date when the grant was last received by the Commission, and to continue it regularly until further notice; (b) to hand over to the Commission the balances in the Hai Ho Improvement Surtax Account, and the Bridge Tax Account; and (c) to hand over to the Commission every ten days as from 1st January 1938 future collections of the Hai Ho Improvement and Bridge Tax. All of which meant an extraordinary increase in the Commission's Revenue for the year 1938.

In a review upon the Influx of silt from the Yung Ting Ho since 1926 and its effect on the Hai Ho and the Bar Channel, the Engineering Department of the Conservancy Commission in their report for 1938 said:- The amount of silt brought down by the Yung Ting Ho is amazing. The quantity deposited in the Hai Ho is computed with the aid of frequent soundings taken in the upper reaches. The depositions are tabulated separately for the Spring and Summer freshet of each year. In order to shew the effect of the Palliative Scheme, the quantities deposited in the Settling Basins have also been computed and tabulated commencing from the Summer freshet of 1932, when the Diversion Works were in operation for the first time. The amount of very fine soil, which does not settle on the river-bed but is carried out to sea in suspension is not included in the amounts given in the table, as a reliable computation for a tidal-river is impossible. Only those quantities which were deposited in the river bed that remained long enough to make measurements possible have been computed and are tabulated below.

In Millions of cubic yards.

During Spring-Freshet		During Summer-Freshet		Annual Totals		
Deposited in Settling Basins	Brought into Hai Ho	Deposited in Settling Basins	Brought into Hai Ho	Deposited in Settling Basins	Brought into Hai Ho	Total
	6.8		7.2		14	14
	3.		10.8		13.8	13.8
	5.6		14.8		20.4	20.4
	1.2		2.8		4.	4
	1.2		9.2		10.4	10.4
	1.4	21.2	9.6	21.2	11	32.2
2	-	26	12.4	28	12.4	40.4
2.2	-	7.4	4.8	9.6	4.8	14.4
-	.4	3.6	-	3.6	.4	4.
1.72	-	15.6	-	17.32	-	17.32
1.6	-	4.8	3.2	6.4	3.2	9.6
.72	-	.08	2.	.8	2	2.8
8.24	19.6	78.68	76.8	89.92	96.4	183.32

Referring to the alarming amount of silt carried by the Yung Ting Ho beyond its delta during 1938, the review remarks that fortunately the

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Settling Basins having by that time been provided, the Hai Ho was relieved of approximately 70% of the amount. By way of illustration the review mentions that if the area of the British Concession at Tientsin were uniformly covered by soil amounting to 40 million cubic yards, the level of the area would be raised by 27 feet. Or, if this quantity were uniformly to cover the bottom of the river from Tientsin to Taku, the area of the Hai Ho's cross-section would be reduced throughout the length of the river by about 30%; and finally the amount would be nearly 30 times that of the largest amount ever dredged by the Commission's plant from Tientsin Harbour and the river in a year, i.e. that of 1928 1,400,000 cubic yards.

A good illustration of traffic at the open roadstead outside Taku Bar was afforded by an excellent photograph taken on the 4th June 1939. This shews besides the Blue Funnel liner "Anas" and the Ben liner "Bennachui" the Tanker "Shabonee" (which was in course of discharging 14,000 tons of Kerosine oil and Gasoline) the lumber ship "Kingwood" (with about 5 million B.M. feet of timber) and the steamers "Hope range", "Harpalycus" "Cuba Maru" "Janetta" "Ettrick bank" "Anten" "Nomea" and "Halsterbo"; most of which were discharging cargoes of Flour.

The great flood of 1939 was of such moment that the Tientsin Press Ltd. compiled and published a special brochure of 32 pages containing photographs and reports prepared by various public bodies. The flood appears to have had its origin from typhonic storms which broke on the mountain ranges South-West of the province; swept down the Nan Yun Ho, Tze Ya Ho and Ta Ching Ho, and besides putting the Hai Ho to its very utmost capacity, caused tremendous pressure against the Outer Protection Dyke previously referred to. Although grass had grown on the outer slope of the Dyke (helpful in resisting erosion) wave-action on the 16th and 17th August, during strong Southerly winds and rain, caused dangerous erosion. And in spite of the utmost exertions or unlimited laborers, furnished with all the tools and materials requisite for repair and strengthening work, the Dyke broke. Persons taking recreation near the Eastern boundary of the grounds of the Tientsin Race Club on Saturday afternoon, the 19th August, saw the water coming across the plain like a bore, and shortly afterwards the premises of the Club were rendered untenable for the members. Meanwhile, several hundred Chinese who lived nearby, occupied the Grandstand as a place of refuge, for themselves and families also ponies in their care, belonging to members of the Club. The whole of the next day saw a stream of distressed villagers making their way into the British Municipal Area, wherein these people secured refuge on any and every place or position that remained above water. During the night of Sunday the 20th, the flood waters enveloped the Chinese City and the Foreign Concessions, except for a small patch at the North-Eastern corner of the British Concession, and a portion of the French Concession. The Italian Concession was the only area on the left bank of the Hai Ho that was sufficiently high in elevation to escape inundation. Eventually the Hai Ho rose slightly above the sills of the Japanese, French and British Bunds and the peak of the flood was measured on the 25th August at 19.2 feet Wu Tsung or about 2½ feet higher than the peak of the Flood of the Autumn of 1917.

From the 22nd until the 27th September both the Hai Ho Conservancy Commission's Pumping Stations, "Chung Hua" and "Yen Yun" pumped 240,000 cbm. flood water out of the British Concession. The "Chung Hua" was connected with the [illegible] dows Road

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and the "Yen Yun" with a 24" filling pipe line laid down in Council Road up to Race Course Road.

From the middle of July until the end of October the Bar was under the predominant influence of the great flood in Hopei Province. During the period 15th August till 15th October the downward flow of the flood-water never ceased. Under normal conditions, the rising tide at sea pours over 1,000 million cb.ft. of tidal water into the river twice every day which is again discharged during ebb tide. During two months (15th August - 15th October) no sea water whatsoever entered the river. The maximum flow of the river during the flood was three times greater than the maximum flow during ebb tide at ordinary times ($4200m^3/sec$. as compared to $1400m^3/sec$.) The maximum total daily discharge during the floods was 360 million cbm. about six times more than the outflow during a day, which is 30 million cbm. per tide or 60 million cbm. per day. As the Hai Ho since 1887 never discharged such huge volumes of water, the effect of the outflow on the Bar was watched with keen interest and a faint hope was entertained that after the heavy silting on the Bar some scouring might take place. But the Bar is too far distant from the river-mouth to be influenced by increased outflows. Only the river entrance from the Deep Hole to the river mouth where the water at Low Water is confined between mud flats, showed much scouring.

The main effect of the flood on the Bar was exceptionally heavy silt deposition. The increase of the output of the river was mainly obtained by the increased speed of the current and not by the but slight increase of the sectional area. This increase of the speed is the result of increased slope of the water surface. With the increase of the surface slope of the flow in the river rose its scouring power and silt-carrying capacity, which resulted in the washing out of 4,700,000 tang of soil from the river bottom. As the whole amount was carried out to the Bar and deposited there, the level of the Bar rose to heights never measured since 1900 and the water depth over the Bar decreased correspondingly.

The first result of the intense rainfall in the hinterland early in July was an increase in the flow and silt content of all tributaries which caused a loss of depth of 1 foot in the Bar Channel already at the end of July. The signalled depth was reduced from 7'6" to 6'6" on the 29th July. The heaviest silt deposition took place during the period 17-23rd August, when the flow of the river increased rapidly as a result of the discharge of water into the river from the inundated plains along both river banks. During these few days 4 feet of depth were lost in the Bar Channel. The signalled depth was reduced from 6.6. to 5.0" on the 17th August, to 4.0" on the 21st 3.0" on the 22nd and to 2.6" on the 23rd August. More silting but at a less rapid rate occurred until the middle of September as the flow of the river remained high. The signalled depth was reduced to 2'0" on the 4th September and to 1'0" on the 15th September. Never since the flood of 1912 was the Bar Channel as shallow as in September 1939 only providing 9 feet of water at Ordinary High Water of - 8' T.D. The silting up of the Bar came to an end in the second half of September when the output of the river and consequently its silt-carrying capacity decreased.

From 1925 until the summer of 1929 no changes took place on the Bar. But great changes took place in the river. In 1927 and 1928 heavy silting had commenced in the upper reaches of the river. As the great silt supply from the Yung Ting Ho continued until 1934 the river bed was gradually shoaled over its entire length from Tientsin to Tangku

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by about 30' the area of the river's cross section. 22,700,000 fang of soil (64 million cbm.) had been brought into the Hai Ho by the Yung Ting Ho during the period 1927-1934. 11 million fang remained in the river bed and 11.7 million fang were carried out to the Bar In the autumn of 1929 the tremendous quantity of 5,060,000 fang was washed out from the river bed during the strong summer freshet and deposited on the Bar. During the flood in 1937 3,200,000 fang were brought out to the Bar and in 1939 4,700,000 fang were transported out to the Bar. The total quantity of soil brought out to the Bar during the period 1929 - 1939 is 21 million fang (59½ million cbm) of which 7,600,000 fang are still deposited now on the flats close to the Bar channel and 13,400,000 fang were either taken away by action of the tidal currents into the deep sea or deposited far north and south of the Bar Channel.

Another remarkable typhoon, which occurred at the end of August caused a high tidal-wave in the Gulf and the flooding from the sea of a strip of land along the coast. Taku, Tongku and Hsin Ho, 7 miles upstream (from the river mouth, which had not been inundated by the flood from the hinterland) were flooded from the sea. The water level of the sea rose to 15.2 feet above Taku Datum on the 31st August at the river mouth a new record since tidal observations are being made (1902). The previous maximum High water at the river mouth, which was observed during a typhoon on the 31st August 1917, was 13.5 feet above T.D.

The river at the end of the year had very good depth, but navigation could not take advantage of the improved depth because of the shallow Bar Channel. [illegible] the permissable draught was increased to 1[illegible] ft. at - 0' [illegible]. The shallowest part of the river is everlasting beca[illegible] the 1[illegible] foot channel is narrow.

The winter of 1939/40 was very mild until the 19th January when an uninterrupted 15 days period of low temperature began, which lasted until the 4th February. The daily mean temperature at Tientsin remained below 7° throughout this cold period. The lowest temeprature during the winter was 14° C recorded on 23rd January.

But little work was required from the ice-breaking plant until the 19th January when the cold weather commenced. The fleet of ice-breakers worked then day and night until the 8th February. Much ice formed in the river, on the mudflats along the coast on the Taku Bar and out to sea.

Shipping did not experience difficulties in the river in spite of the great amount of ice which formed there. Only at the bend close to the river mouth occurred ice-jams which on some occasions were difficult to pass.

But navigation became difficult when an easterly wind began to blow on 27th January with the result that all the drift ice in the Gulf moved towards the [illegible], [illegible] ice-sheets were tightly pressed to the sea-shore by the wave. [illegible] to hoist signal "difficult" had to be broadcast on [illegible] January. Navigation became easier in the [illegible] of the [illegible], as all the ice which had accumulated in the deep Pei-ho and on the Bar was blown out to sea by a strong South- easterly wind. [illegible] and several tugs were on this occasion driven over 30 miles to the southeast of the Taku anchorage with the large icesheets surrounding them. All the vessels were brought back to the Bar on 5th February [illegible] Ling".

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Ice conditions "favourable" was broadcast beginning from the afternoon on the 7th February until the end of the ice-season on 23rd February when the ice-breaking service was discontinued.

The dredger worked day and night during the greater portion of the season in order to not only cope with the enormous resilting but also to attempt improvement of the depth. The total amount of soil dredged by the "Huai Li" during 1940 amounts to 282,000 cbm. Which is about three times more than the amount dredged per year formerly.

In spite of the improvement which took place during the year, the Bar is still at a higher level than during any time of the 60 years period 1878-1938. During these 60 years the Bar was in the worst condition in 1905.

The signalled depth of the Bar-Channel at the beginning of the year was 8 feet below T.D.

Soundings taken on 2nd December showed that the Center-Line of the channel was 8'8" below T.D. and the shallowest section of the south-line was 8'3" below T.D. Only a short distance of the north-line showed a depth of 8' below T.D. While the other part was considerably deeper. The depth was still further improved in December until the dredging was interrupted on the 19th. The signalled depth was increased only to 7'6" below T.D. on 7th December although soundings indicated a good margin for a depth of 8' below T.D. It was considered advisable to provide a large margin over the signalled depth this year in view of the high level of the bar-areas close to the channel with the consequent heavy resilting by wave-action during the winter when no dredging is being done.

The winter 1940/41 was very mild and the amount of ice which formed in the river and on the bar was small. Shipping did not experience any difficulty on account of ice and never required the full service of the ice-breaking plant.

Ice-breaking operations were commenced on a reduced scale on 14th January when thin ice covered the river-surface and were discontinued on 19th February. The daily ice-condition signals were broadcast from Station "XRNI" on the Commission's ice-breaker "Ching Ling" during the period from 14th January 1941 to 19th February 1941. The winter was so mild and the amount of ice so small that "ice conditions favourable" could be broadcast during the whole period.

Dredging operations of the Bar-Channel with the suction-hopper dredger "Huai-Li" were commenced on 28th March. The dredger worked day and night during the whole dredging season and excavated a total volume of 312,740 cbm., the largest annual dredging output ever recorded during the 20 years period since the commenced work in 1921. The dredging had to be extended from the bar-channel to the outer portion of the Deep Hole in July, as the channel had been dredged deeper that the "Deep Hole". The distance of dredging was thus increased from 1.5 km. to 3 km.

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The signalled depth at the beginning of the year was 7'6" below T.D. The channel was improved considerably during November so that on 1st December, the shallowest part of the Channel-Center-Line was 12'7" below T.D. It was again considered advisable to provide a large margin over the signalled depth in view of anticipated resilting by wave-action during the winter, which may be heavy, because of the high level of the bar-areas on both sides of the channel. The signalled depth was therefore not increased again but remained at -9' T.D. The min.margin over this signalled depth at the shallowest sections is 7" on the North-Line, 3'7" on the Center-Line and 1'11" on the South-Line.

The summer rainfall was very small in Hopei with the exception of the drainage-basin of the Hai Ho. A great number of cyclonic rainstorms moved from the South-Pacific towards Kiushu but none of them turned towards the west into Hopei. All typhoons took a course over the islands of Japan or to the south-east of Japan. The summer of 1941 was exceptionally dry in Hopei.

The permissible draught for steamers navigating up to Tientsin was 16 foot at Ordinary Highwater of 8 ft. T.D. at the beginning of the year. In June, Everlasting Reach was the shallowest portion of the water-way from the deep sea to Tientsin. As the depth in the Bar-channel had been improved by dredging, the Everlasting Reach was therefore deepened simultaneously with the bar-channel and the permissible draught was increased to 17 ft. at Ordinary Highwater of - 8' T.D. on 3rd July. This depth was maintained in spite of considerable silt-deliveries from the Hu Tho Ho and Yun Yun Ho during the summer freshet. The silt-content of the Hai Ho at Tientsin had increased during the spring freshet to a maximum of 898 per million on 27th February but during the summer it reached a maximum of 3797 per million. The silt-content remained above 1000 per million (0.1%) for a long period, from the 2nd July until the 17th September. 300,000 cbm. of silt were deposited in the upper reaches of the Hai-Ho, raising the elevation of the river-bed in the navigable channel by about 1 foot. But the depth remained unchanged as the Highwater levels had also risen by 1 foot during the summer freshet. 1,500,000 cbm. of silt were carried downriver out to the bar because of the strong tidal-currents which were running in the Hai Ho during the summer. Such a large amount of silt was carried out to sea in suspension because the silt was of very fine grain, especially the reddish clay supplied by the Hun Yun Ho.

Not only the low water but also the tidal-range reached a new record during the year. The mean monthly rise and fall of the tides at Tientsin rose for the first time above 7 ft. in July 1941 and reached a maximum of 7.32 ft. during August. The mean annual tidal-range at Tientsin rose in consequence of river-improvements from 0.60 ft. in 1902 to 2.70 ft. in 1910, 5.61 ft. in 1920 and to 5.98 ft. in 1926. The tidal-range decreased due to the silting of the Hai-Ho during the period 1927-1934 to 4.70 ft. in 1930 and to 3.35 ft. in 1934. It rose again because of the great improvements in the river to 5.62 ft. in 1940 and reached a new record with 6.52 ft. in 1941.

The year 1941 must be considered as one of the most satisfactory years in regard to the depth available in the water-way from the sea to Tientsin. Dredging in the bar-channel was so successful that the shallowest sections of the river, the Everlasting Reach, had to be deepened by dredging in order to keep the river and the bar-channel at an equal depth.

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The past 40 years show that the river was always deep after flood-years and the bar-channel shallow. The upper reaches of the river were usually silted up again by the Yung Ting Ho as soon as it was possible to increase the depth in the bar-channel. Shipping interests had to be satisfied with a good river and a bad bar or a good bar and a bad river.

The representative of the Consular Body on the Board of the Hai-Ho Conservancy Commission (as finally formed in 1902) has consisted of:- British Consuls for 15 years, French Consuls for 10 years, German Consuls for 3 years, Russian Consul for 1 year, Japanese Consuls for 7 years and American consuls for 4 years.

Commissioners of Customs have served as follows: German 5 years, Dutch 2 years, American 2 years, British 28 years, French 3 years, Italian 2 years.

Chairmen of the Tientsin General Chamber of Commerce have served as follows:- British 38 years, American 1 year, German 1 year.

The Secretaryship was held by British subjects until July 1940, when a Japanese was appointed.

Shortly after the Empire of Japan had declared War against the United States of America and the British Empire, the remaining three British subjects in the employ of the Board were dismissed on account of their nationality.

In addition to the Viceroy's Contribution of Taels 100,000 in 1898, and the grant by the Tientsin Provisional Government during 1901 of Taels 250,000 the Commission has raised loans a total of Taels 2,560,000 and $1,850,000 of which $1,281,200 was outstanding on the 31st December 1941.

Besides the monthly grant of Taels 5,000 made by the Tientsin Provincial Government from 1st June to the 15th August 1902; since continued by the Chinese Government in accordance with the Peace Protocol, and amounting up to the 31st December 1941 to $3,673,104; the Commission has collected other Revenue as follows:-

River Dues (Aug.1898 to Oct.1901 @ 1% of Customs Duties, Oct.1901 to Sep.1903 @ 2%, Sept.1903 to June 1908 @ 3%, June 1908 to Dec.1908 @ 3½%, Jan1909 to Dec.1941 @ 4%) ..$16,917,453. Shipping Tax from 1908 to Dec.1941 @ 10 candareens per registered ton on vessels that cross the Bar and @ 5 candareens per ton on vessels that remain outside the Bar; the latter having the option of paying 10 candareens per ton on all inward and outward cargo carried ...$7,588,164 Also in respect of 4,594,194 fang (1,705,635 cubic yards) of Dredged Spoil pumped ashore at Tientsin for filling-in ponds and raising the level of land, the Commission collected from Land-owners $2,455,273 Further, since 1938 the following additional funds have been handed over to the Hai Ho Conservancy Commission:-

Hai Ho Improvement Surtax	$ 8,025,139
Bridge Tax	8,165,481

At the end of 1941 the Commission's Fleet consisted of:- Stationery Dredger "Pei Ho" and 2 Grab Dredgers (1902), Universal Dredger

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"Hsin Ho", Pumping Station "Yen Yun", 6 Hopper Barges 900 ft. Floating Pipe 20" and Steam Tug "Chan Chieh" (1910) Suction Dredger "Chung Hwa" and 2 Hopper Barges (1915) Stationary Dredger "Hsi Ho" and 2 Hopper Barges (1914/15) Bar Dredger "Kuai Ai" (1920) Dredger "Kao-Lan" and 2 Hopper Barges (1924) Ice-Breakers "Kai Ling" and "Tung Ling" (1913) "Hoi Ling" (1914) "Ching Ling" (1919) "Kung Ling" (1920) and "Foi Ling" (1925) and sundry small boats.

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